# *Chapter 7 – DETAILED ANALYSIS OF ALTERNATIVES AND SELECTION OF PREFERRED ALTERNATIVES*

## *7.1 Introduction*

This chapter evaluates how each alternative, retained from the screening of alternatives in Chapter 6, would be applied to each RU at the Site and presents a comparative analysis of these alternatives. Some alternatives evaluated in Chapter 6 are not appropriate for smaller scale applications (less than 2 acres in size or 5,000 cubic yards in volume). As such, this section will be include both the evaluation of the preferred alternative for larger scale (ranging from greater than 2 acres in size to total Site remediation) and the alternatives that may be used for small scale applications less than 2 acres.

In addition to the No Action alternative, which is retained as a baseline, the three primary remedial alternatives (to be used on a large scale basis) considered in the detailed analysis are as follows:

- On-Site Deposition, Cap and Cover;
- Off-Site Disposal at a Landfill; and
- Wet Screening with On-Site Deposition, Cap and Cover and Disposal of the Residual Soils at a Landfill.

In addition to the No Action alternative, which may have limited applications, the four primary remedial alternatives (to be used on a small-scale basis) considered in the detailed analysis are as follows:

- Cap;
- Cover;
- Cap/Cover; and
- Off-Site Disposal at a Landfill.

The details of how each alternative is able to successfully treat soils from different RUs are crucial to evaluating the alternatives. Not all RUs can be treated by each alternative; an alternative may be selected as the preferred alternative based on its effectiveness in treating a particular RU. The applicability of the alternatives to each specific RU is discussed in Chapters 5 and 6.

Section 7.2 describes the alternatives being retained for detailed analysis and identifies the large-scale RUs and volumes of soil which these alternatives may treat. Section 7.3 is the comparative detailed analysis of these alternatives. It also describes the evaluation criteria and rates each alternative. Section 7.4 summarizes the analysis of the alternatives. Section 7.5 describes the preferred alternatives for large-scale RUs, and any adjustments that implementation of the alternative would have on Site-specific RLs.

Section 7.6 describes the alternatives being retained for detailed analysis and for use in small-scale applications and Miscellaneous Small RUs. Section 7.7 is the comparative detailed analysis of these alternatives. It also describes the evaluation criteria and rates each alternative. Section 7.8 summarizes the analysis of the alternatives. Section 7.9 describes the preferred alternatives.

The detailed analysis of alternatives presents comparative results on the performance of each alternative for each RU. The most consistently performing alternatives are described in detail in Chapter 8.

## *7.2 Description of the Alternatives Retained for Detailed Analysis – Large Scale Applications*

The following descriptions of alternatives are presented as they would be implemented for the RUs described in Section 3.2. These descriptions define how the alternative achieves the RAOs.

### *7.2.1 No Action*

This alternative is retained for the purpose of comparing the current Site condition to the result of implementing any of the other remedial alternatives. No Action does not meet cleanup standards and will not be used for large-scale applications.

### *7.2.2 Common Activities*

Certain common activities will be required for remediation of Site soils when the remedial alternatives involve excavation of in-place soil. These common activities include excavation, stockpiling, characterization and verification sampling and analysis, and regulatory classification of stockpiled soils prior to off-Site disposal, treatment, or on-Site deposition.

**Analytical Field Screening:** Where necessary (e.g., debris areas), field-screening samples will be collected to guide the cleanup action and allow for more cost-effective excavation of the impacted soil.

**Site Preparation:** Clearing and grubbing would be done once approval to proceed is given by Ecology. During this task, all vegetation would be removed from the areas to be excavated. Vegetation would be chipped and deposited on-Site. The work areas will be inspected by trained archeologists to determine if cultural or archeological artifacts are present. If any artifacts are found they will be treated in the manner described in the Cultural Resource Protection Plan that will be part of the Cleanup Action Plan (CAP) for the Site.

**Excavation:** Soil above the RL will be excavated to a depth of one foot of soil in impacted areas as delineated by the RI or by additional sample data, except in specific areas where soils are impacted at depths greater than one foot.

**Verification Sampling and Analysis:** Verification soil samples (i.e., 5-point composites) will be collected from the excavated area and analyzed. Analytical results will be evaluated to determine compliance. If soil remaining in the excavation does not meet Site RLs or, if applicable, CLs, additional excavation and verification sampling and analysis will be performed.

**Haul/Stockpile:** Excavated soil will be transported directly to either a low exposure risk area (e.g., golf course areas) for deposition or transported to a central area and stockpiled in preparation for treatment or disposal.

### *7.2.3 On-Site Deposition, Cap and Cover*

**General Process:** In general, this alternative would involve the mass excavation of the top one foot of soil in targeted areas of the project Site, followed by the transfer of the excavated soil, and the consolidation of these soils in selected locations on-Site. Additional excavation would be required for soil greater than one foot below current ground surface if either confirmational or RI testing showed that they contained contaminant concentrations greater than CLs. Each of these consolidation locations would be capped and lie beneath the planned golf course.

**Excavation Methods:** Excavation of soils greater than the Site-specific RLs for lead and arsenic would occur by the following methods. All excavation work done within the first three feet of the current ground surface will be monitored by trained archeologists to determine if cultural or archeological artifacts are present. If any artifacts are found they will be treated in the manner described in the Cultural Resource Protection Plan that will be part of the Cleanup Action Plan (CAP) for the Site.

**Method 1) Scraping:** The majority of the shallow soils (up to 1.0 foot deep) will be excavated using self-loading pan scrapers. This method would be used on those areas within Parcel 1 that are not historical or open space RUs. Some selected excavation could occur within the golf course areas. The general scraping process would be:

- Phase I – The upper six inches of soil would be removed, using a self-loading pan scraper.
- Phase II - The remaining six inches of soil would be graded into a windrow and picked up by the pan scraper. If gravel were encountered prior to reaching the target depth, further excavation would be terminated at the gravel layer. The gravel represents a natural barrier to penetration of the subsurface by burrowing organisms. GPS will be used confirm the initial depth, followed by a complete survey to confirm the depth excavated.

**Method 2 – Selected Excavation**:

- In those areas not accessible to the pan scrapers (because of topography or other reasons), an excavator will be used to selectively excavate the soil in six to eight inch lifts until the desired depth of one foot. The excavated soil will be loaded into off-road haul trucks and transported to the PAs for placement. Direct pushing of soils into the PA is also possible for areas adjacent to the PAs. GPS will be used to confirm the initial depth, followed by a complete survey to confirm the depth excavated.

All of the material excavated, by either method, will be placed in the placement/consolidation areas (PAs) within the golf course areas and rough-graded.

**Cap Construction:** A golf course would be constructed on the project Site as an engineered cover (cap) for contaminated soils and, if necessary, contaminated debris. The majority of this material would be imported from the commercial land use areas of Parcel 1 and consolidated in roughly 73 acres of the approximately 180-acre golf course footprint. These 73 acres would constitute the PAs. Only soils and debris that contain contaminant concentrations equal to or less than the golf course remediation levels would be placed in the PAs. Each PA would be capped with 18 inches of clean soil by one of the following two methods listed below. This cap would also be placed on any areas within the golf course with in-situ contaminant concentrations (if not excavated) less than the golf course remediation level but greater than the Site-specific commercial remediation level.

- **Method One:** Six inches of clean soil would be placed over 12 inches of pit run gravel. In this process, the gravel would act as an exposure barrier to ecological receptors. The six inches of clean soil would act as an additional exposure barrier to individuals most likely to be exposed—the golf course worker, who on occasion may find it necessary to install drainage ditches or repair irrigation pipe.
- **Method Two:** Eighteen inches of “pit run” soil would be placed over a geotextile. In this case, the 18 inches of soil would act as the human health exposure barrier and the geotextile will act as the ecological exposure barrier.

**Application:** This alternative is potentially applicable to the following RUs:

- Golf Course RUs, and
- Commercial RUs

The volume of impacted soil associated with these RUs is approximately 714,000 CY.

### *7.2.4 Off-Site Disposal at a Landfill*

**General Process:** This alternative would involve the excavation of a minimum of one foot of soil in targeted areas of the project Site. Since the planned golf course would not be constructed under this option the acreage excavated and, thus, the volume would be larger than other retained alternatives. Additional excavation would be required for soil greater than one foot below current ground surface if either conformational or RI testing showed that they contained contaminant concentrations greater than CLs. The excavated soils would be stockpiled, sampled, and transported to an approved off-Site disposal facility.

**Application:** This alternative is potentially applicable to the following RUs:

- Golf Course RUs;
- Commercial RUs ; and

The volume of impacted soil associated with these RUs is approximately 1,190,500 CY.

### *7.2.5 Wet Screening with On-Site Deposition, Cap and Cover and Disposal of Residual Soil at a Landfill*

**General Process:** This alternative would involve the excavation of a minimum of one foot of soil in targeted areas of the project Site. Additional excavation would be required for soil greater than one foot below current ground surface if either confirmational or RI testing showed that they contained contaminant concentrations greater than CLs. These soils would be stockpiled prior to wet screening. Wet screening, as described in Chapter 6, is an effective technology for reducing the total volume of soil needing treatment. Based on the treatability study conclusions and the results of the 2001 Screening Program, it is assumed that wet screening will concentrate the lead and arsenic in the soil into 10 percent of the original soil volume. The residual soils would be loaded into 30-ton haul trucks, transported to and disposed of at an approved landfill. The process soil that met Site-specific golf course remediation levels would be transported to the golf course PAs for on-Site deposition and contained under a cap/cover. Section 7.2.3 describes the cap construction methods.

**Application:** This alternative is potentially applicable to the following RUs:

- Golf Course RUs;
- Commercial RUs; and

The volume of impacted soil associated with these RUs following wet screening is approximately 714,000 CY.

## *7.3 Comparative Detailed Analysis of Alternatives – Large Scale Applications*

The following analysis provides information for the selection of a preferred alternative for each RU. This detailed analysis of alternatives will be comparative. The advantages and disadvantages of each retained alternative are identified and compared against the other alternatives to determine their relative performance according to each criterion.

The threshold criteria—protection of human health and the environment and compliance with cleanup standards—are those criteria that must be met for the alternative to have been retained from the screening described in Chapter 6. Each retained alternative meets the threshold criteria for lead and arsenic soils, with the exception of No Action, which is retained for comparison with the current Site condition.

The comparative analysis describes the evaluation criteria and presents the most favorable alternative first and includes the remaining alternatives in decreasing order of ability to satisfy the criteria.

The criteria to be used for the comparative detailed analysis of alternatives include the following:

- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, and volume;
- Short-term effectiveness;
- Implementability;
- Cost; and
- Consideration of Public Concerns.

### *7.3.1 Long-Term Effectiveness and Permanence*

Long-term effectiveness measures the effectiveness of the cleanup action after the cleanup standards have been met. The primary focus of this comparison is to weigh the controls that may be necessary to manage the treatment residuals or untreated soil. This is done in two ways: by assessing the magnitude of the residual risk; and by assessing the adequacy of the individual controls to manage the treatment residuals or untreated soil. This long-term effectiveness comparison does not consider the residual risk or controls that may be associated with the off-Site landfill alternatives. The evaluation of "certainty of success" was omitted from this evaluation since each of the cleanup alternatives being evaluated will need to attain cleanup standards before demobilization can occur. The cleanup of the Site will be performed over a period of time during which "success" can be measured with a high degree of certainty for each process.

**Magnitude of Residual Risk on Site:** Each remedial alternative will have low residual risk since each will leave only acceptable concentrations of constituents (below either cleanup or remediation levels) on Site. Some alternatives have less residual risk than others. Excavation of soil above the RL means that the Site meets the remediation levels, which are based on acceptable levels of risk. The following discussion relates to the relative magnitude of low residual risk from residual soils generated by each alternative.

- The least residual risk on Site will be associated with Off-Site Disposal at a Landfill. Implementation of this alternative will result in no soil above the CL remaining on the Site.
- Slightly more residual risk will be associated with the Wet Screening with On-site Deposition, Cap and Cover and Disposal of Residual Soil at a Landfill and On-Site Deposition with Cap and Cover alternatives, which include off-Site disposal of soils exceeding the golf course RL. Risk is further reduced by minimizing the potential for direct contact exposure routes with the use of a Cap/Cover.
- The No Action alternative would not modify the current Site condition and residual risk would be similar to the current risk. Future land uses would be restricted and current access restrictions would be maintained.

**Adequacy and Reliability of Controls:** The adequacy and reliability of controls relate to future land uses at the Site. Long-term development plans would impact only the No Action alternatives.

- Off-Site Disposal at a Landfill will require the lowest degrees of long-term management. Environmental audits of appropriate off-Site landfill facilities have determined that current controls implemented at those facilities are acceptable.

- Both On-Site Deposition with Cap/Cover and Wet Screening with On-site Deposition, Cap and Cover and Disposal of Residual Soil at a Landfill rely on the Cap/Cover to reduce the potential for exposure to humans and ecological receptors. The Site development plans support the long-term management of these soils if they are located under the golf course.

- No Action would require that general access to impacted areas be restricted. Application of various institutional controls may be required to prevent exposure.

### *7.3.2 Reduction of Toxicity, Mobility, and Volume*

This evaluation criterion addresses Ecology's preference for selecting remedial alternatives that use treatment technologies that permanently and significantly reduce toxicity, mobility, and volume of the constituents in Site soils. This evaluation focuses on the ability of alternatives to reduce the total volume of impacted soils, and irreversibly reduce mobility and toxicity of the constituents.

Implementation of any of the alternatives, except No Action, will address the highest concentrations of constituents in the soil.

**Total Volume Reduction:** Reduction of the volume of impacted soils is compared in this evaluation. Because metals are present in Site soils, destruction/reduction of the elemental constituents is not an option; thus, only soil volume reduction is considered.

- Wet Screening with On-site Deposition, Cap and Cover and Disposal of Residual Soil at a Landfill has the potential to reduce the total impacted soil volume by up to 90 percent. As such, it represents the alternative that results in the highest amount of volume reduction.

- Off-Site Disposal at Landfill, On-Site Deposition with Cap/Cover and No Action would not reduce the volume of impacted soil. Off-Site Disposal would result in the material being transported from the Site and placed in an engineered landfill.

**Mobility Reduction**. The reduction of mobility is based on the alternative's ability to permanently prevent constituents from transport along potential exposure pathways. Since stabilization and other technologies that reduce leachability do not meet cleanup standards, the pathway considered is direct contact. Alternatives that involve excavation of soil above the RLs would permanently reduce the potential for direct contact exposure in the excavation area by removing the source of constituents.

- Off-Site Disposal at a Landfill would result in all soil above CLs being transported to a controlled landfill, where the mobility of the constituents would have to be controlled with liner and cap containment for the long term.

- Wet Screening with On-site Deposition, Cap and Cover and Disposal of Residual Soil at a Landfill would indirectly reduce the mobility of the constituents because this treatment results in a smaller portion of the impacted Site soils being available as a potential future source for migration. The coarse material returned to the Site would not be a significant source for direct contact exposure. This alternative also reduces the possibility of direct contact with contaminated soil by using a Cap/Cover.

- The On-Site Deposition with Cap/Cover alternative also reduces the possibility of direct contact with contaminated soil by using a Cap/Cover. Developing and following health and safety procedures could limit exposure to workers during future subsurface construction or maintenance at deposition locations.

- No Action would not reduce the mobility of the constituents at the Site.

**Toxicity Reduction:** This evaluation is based on the ability of the alternative to destroy or convert the Site constituents to a less toxic form. Lead and arsenic in Site soils are elemental, and their destruction is not practical. None of the retained alternatives are intended to reduce the toxicity of lead or arsenic in soil.

### *7.3.3 Short-Term Effectiveness*

This evaluation criterion addresses the effects of the alternative during the construction and implementation phases of the cleanup action. Each alternative is evaluated with respect to the potential impact on human health of the surrounding community, site workers, and the environment.

**Potential Community Exposure during Implementation:** This aspect of short-term effectiveness addresses any risk that results from implementation of the proposed alternative, such as dust generation during materials handling and transportation, and air emissions resulting from equipment operation. Dust generation would require monitoring so that the level of dust generated during soil handling does not exceed allowable levels in downwind areas. Dust control methods (i.e. applying water to work areas prior to and during excavation) would be required. The air quality impacts would be monitored to protect both Site workers' health and safety. In addition, work done within 500 feet of the southern boundary of the Site would require perimeter dust monitoring and dust prevention measures. Transportation of soils off-Site may have a very low potential for exposure. As a result the quantity of material being treated on-Site and/or transported to an off-Site landfill is the basis for this evaluation.

- No Action has the lowest risk associated with implementation since no soil is treated or removed from the Site.

- On-Site Deposition with Cap/Cover will require management of dust generation associated with the blending and amendment of soil or excavation and deposition. Only a small volume of soil would be transported off-site with this alternative.

- Wet Screening with On-site Deposition, Cap and Cover and Disposal of Residual Soil at a Landfill, since it would be concentrating contaminants, would generate a greater volume of soil that requires off-site disposal than On-Site Deposition with Cap/Cover. It also requires a greater degree of soil handling since not only is the same volume of soil excavated, as On-Site Deposition, but it is also screened. This alternative will require management of dust generation associated with the excavation and handling of the soil, and during any subsequent deposition of treated soils on the Site.

- Off-Site Disposal at a Landfill will require the most controls to minimize risk associated with dust generation. Dust generation associated with the excavation of the soil and transportation will require management because all soils above CLs will be transported to an appropriate landfill.

**Potential Worker Exposure during Implementation:** This factor assesses potential threats that may be posed to the workers and the effectiveness and reliability of protective measures that would be taken during implementation of the cleanup action.

Personal protective equipment (PPE) appropriate for the type of potential exposure would be worn to reduce worker exposure. Workers would be trained in the health and safety procedures appropriate for their respective tasks, and operation of equipment (trucks, backhoes, and other heavy equipment) and would comply with the appropriate safety regulations.

Several alternatives would generate dust and/or require transportation to a landfill during implementation. Dust generation will be managed by wetting the soil during handling, paving the centralized treatment area, and/or covering stockpiles when not adding or removing material. Transportation of soil to the landfill will be managed by conforming to applicable Department of Transportation regulations.

The total volume of material handled and the use of water or extraction solutions are the leading criteria for this evaluation.

- Since no excavation, transport or processing of contaminated soils occur, No Action has the lowest potential for worker exposure.

- On-Site Deposition with Cap/Cover requires management of dust generated during the excavation, transport and on-Site placement of soils, and the construction of the Cap/Cover.

- Off-Site Disposal at a Landfill requires management of dust generated during the excavation, transportation and off-Site disposal of the soils.

- Wet Screening with On-site Deposition, Cap and Cover and Disposal of Residual Soil at a Landfill will require management of dust generated during excavation, processing, transport and on-Site placement of soils, construction of the Cap/Cover, and transportation and off-Site disposal of the soils. In addition, workers will require additional PPE to prevent injury from the moving parts of the screening plant.

**Potential Environmental Impacts:** This factor addresses the potential adverse environmental impacts that may result from the implementation of the alternative and evaluates the mitigation measures which could be implemented to prevent or reduce these impacts. Potential environmental impacts include but are not limited to: dispersion of constituents; treatment water releases; spills; and wildlife exposure. All alternatives (except No Action) are believed to have the same impacts during the initial excavation of soils.

- Since no remedy would be implemented No Action has the lowest potential for adverse impacts on the environment during the implementation. It does, however, represent the alternative with the highest residual risk since no cleanup would have taken place.

- Off-Site Disposal at Landfill will have the lowest potential for adverse impacts on the environment during the implementation.

- On-Site Deposition with Cap/Cover will have a low potential for environmental impacts. The lead and arsenic constituents contained in soils amenable to cleanup action by these methods do not readily leach. If soil spills occur from the loading of trucks, they will be re-excavated. The underlying soils will be sampled to ensure the completeness of the cleanup.

- Since the screening plant would be placed upon a containment pad designed for the containment of soil and water spills, the Wet Screening with On-site Deposition, Cap and Cover and Disposal of Residual Soil at a Landfill alternative will have a low potential for adverse impacts. It will have greater potential for impacts (vs. the above alternatives) due to increased handling of the soil. Process water is expected to contain only low to negligible metal concentrations, so the impact of a release of process water, if it occurred, would be low.

**Time to Achieve RAOs:** This factor estimates the time required to achieve the RAOs for the Site. The reduction of the constituent concentrations in the Site soil or the exposure risk to meet RAOs will be achieved by each alternative except the No Action alternative. The alternatives could be implemented in a timeframe that is principally limited by the time to complete excavation, verification sampling and analysis and, for the Off Site Disposal at a Landfill alternative, the time required to load and transport the contaminated soil off site. For the purposes of the cost evaluation the following was assumed:

- No Action would be completed immediately.

- On-Site Deposition with Cap/Cover was the fastest active alternative with a duration of 2.8 years.

- Wet Screening with On-site Deposition, Cap and Cover and Disposal of Residual Soil at a Landfill alternative would require approximately 3.6 years to complete. This duration is based on a processing rate of about 1,250 tons per day, a six-month mobilization and start-up period, and a six-month demobilization and cleanup period.

- Off-Site Disposal at a Landfill will have the longest duration, 7.6 years, since the number of available trucks and the maximum truckloads per day limit the process. Table 7-1 lists the timeframes of each retained alternative.

### *7.3.4 Implementability*

The Implementability criterion addresses the technical feasibility of implementing the alternative and the availability of materials and services. This evaluation will focus on the following criteria: ability and reliability of the technology to operate as would be required by the design and implementation schedule; ease of undertaking additional cleanup actions; and availability of services and materials. Additional criteria, such as availability of equipment, availability of commercially demonstrated technologies, administrative and regulatory requirements, scheduling, availability of appropriately sized equipment, construction access, and monitoring access, are considered to have minor impacts on the retained alternatives being evaluated in this section.

**Ability and Reliability of Technology:** This evaluation relates to the technical difficulties and unknowns associated with the alternative. Technical problems associated with the implementation of the alternative may prevent attainment of the remediation or cleanup levels or result in delays in the cleanup schedule.

- No technical difficulties or problems would be associated with the No Action alternative.

- On-Site Deposition with Cap/Cover would be readily implementable.

- Off-Site Disposal at a Landfill would be readily implementable. Capacity of the landfill is not a limiting factor and only small transportation problems are anticipated. No delays in the excavation and disposal process are anticipated.

- Wet Screening with On-site Deposition, Cap and Cover and Disposal of Residual Soil at a Landfill could be readily implemented. Wet screening technologies have been proven on large scales at several sites and have been successfully used on the Site. Only minor delays associated with the startup of a process containing a number of mechanical operations are anticipated.

**Ease of Undertaking Additional Actions:** This evaluation discusses what, if any, future cleanup actions may be necessary and how difficult it would be to implement such additional actions after soil treatment by one or more of the alternatives.

- No Action would not modify existing Site conditions so that additional actions would be easy to implement.

- Off-Site disposal would be considered a permanent solution. Further cleanup actions would not be anticipated following the implementation of these permanent disposal and/or treatment alternatives.

- Any additional actions associated with the On-Site Deposition with Cap/Cover and Wet Screening with On-site Deposition, Cap and Cover and Disposal of Residual Soil at a Landfill would be associated with the placement areas. As long as permanent structures, such as buildings, are not constructed on top of PAs in the golf course land use area, subsequent action, if required, could be readily implemented in these areas.

**Availability of Services and Materials:** This evaluation considers the availability of the materials and equipment to implement the alternative, as well as the availability of contractors to provide competitive bids. Cleanup actions directed toward soil impacted with lead and arsenic have been and are currently being implemented throughout the Northwest, North America, and Europe. Many vendors were questioned regarding the technology they use, and the information they provided was used in the screening of alternatives. These same vendors continue to provide updates on their activities and new developments in the technologies as a result of field demonstrations of soil treatment. The screening of alternatives also identified remedial technologies that are not complex to operate and use common construction processes and equipment. Based on these considerations, the availability of services and the necessary materials to achieve the RAOs are not anticipated to be a limiting factor and are unlikely to impact schedule for any of the remedial alternatives.

### *7.3.5 Cost*

This evaluation includes an assessment of costs that may be incurred during the cleanup action. The evaluation considers three cost categories: direct cost; indirect cost; and long-term operation and maintenance (O&M) cost and present the sum for each alternative.

**Direct Capital Costs:** Direct capital costs are considered to be those costs associated with the implementation of the remedial alternative for impacted soil at the Site. These costs are associated with construction, equipment, Site preparation, operation/maintenance, and disposal. Direct costs were obtained from several sources, including vendor solicitations, previous experience, and actual costs for disposal of soil generated during interim source removal at the Site. The ranges of direct costs compiled from these sources are presented in Tables 7-2.

**Indirect Capital Costs:** Indirect capital costs are those costs associated with administration, community relations, engineering design, construction oversight, and contingency for the alternative. These costs were estimated based on previous experience during interim source removal. Detailed tables of the cost estimates are provided in Appendix F. Tables 7-3 presents a summary of estimated indirect remediation costs.

**Total Costs:** Table 7-4 presents a summary of the total costs estimated for each alternative. They are:

- No Action represents the "no cost" option.
- On-Site Deposition with Cap/Cover represents the second lowest cost, ranging between $ 13.2 MM and $ 21.6MM.
- Based upon the costs associated with the 2001 Screening program costs for Wet Screening with On-Site Deposition, Cap and Cover and Disposal of Residual Soil at a Landfill would range between $46.6MM and $ 79.6MM. The average of this range is approximately 4.6 times higher than the average cost for On-Site Deposition with Cap/Cover.
- Off-Site Disposal at a Landfill represents the high cost estimate ranging between $ 181.3MM and $ 248.8MM. The average of this range is approximately 12.6 times higher than the average cost of On-Site Deposition with Cap/Cover and approximately 2.7 times higher than the average cost of Wet Screening with On-Site Deposition, Cap and Cover and Disposal of Residual Soil at a Landfill

**Accuracy of Estimate:** The estimates used on Tables 7-2 through 7-4 present the range of estimated total costs. These estimates of remedial action cost are assumed to be accurate to within -30 percent and +30 percent of the estimate where both estimates could vary by –30 to +30 percent of the listed value. In effect, the estimated "Best Estimate" remedial action cost would be defined as average of the high and low estimate. Additionally, cost estimates, which overlap by about 50 percent, should be considered equal for the purpose of this evaluation.

Note that the estimated total cost of Site remediation based on the preferred alternatives and the cost of completed ISR work at the Site is presented in Chapter 8.

#### *7.3.6 Consideration of Public Concerns*

MTCA calls for the evaluation of any local community concerns over the alternative and how the alternative addresses those concerns. Concerns over protection of cultural and historical sites and artifacts, long-term public health, and short-term public health have been addressed above. Concerns related to any additional short-term impacts, not covered above, are focused on the danger of truck traffic during off-Site disposal.

- On-Site Deposition with Cap/Cover represents the least public health and safety concerns since it represents the alternative with the least volume of soil leaving the Site and, with the installation of the Cap/Cover, minimizes the potential for exposure.
- Public concerns associated with Wet Screening with On-Site Deposition, Cap and Cover and Disposal of Residual Soil at a Landfill would be slightly higher than On-Site Deposition with Cap/Cover since more truck traffic would occur due to the greater volume of soil requiring off-Site disposal.
- Off-Site Disposal at a Landfill would require approximately 44,000 truckloads over 5.1 years and, thus, would cause great public concern.
- Public health and safety concerns should be highest under the No Action alternative since there would be no reduction in contaminant concentrations or potential for exposure.

### *7.4 Summary of the Detailed Analysis*

Table 7-5 summarizes each alternative based on the results of comparative detailed analysis. For each evaluation criteria, each alternative was discussed in descending order of performance according to that criterion. Table 7-5 was prepared by giving the highest performing alternative a score of 1 and the weakest performing alternative a score of 5. In cases where it was not possible to distinguish performance given between alternatives, those alternatives were discussed together and given equal scores.

The subtotal scores for each evaluation criteria category (e.g. long-term effectiveness, Implementability, etc.) and the overall score for the sum of all criteria are presented in Table 7-5. Note that the lowest score indicates the best performance. The results obtained using this method are based on an equal weighting of each sub-criteria. This approach is consistent with MTCA guidance, which emphasizes the permanence of the selected remedial alternatives.

### *7.5 Preferred Alternative for Large Scale Applications*

Based on the best overall score, On-Site Deposition with Cap/Cover is the preferred alternative followed by the Wet Screening alternative. Off-Site Disposal at a Landfill received the highest score making it the least attractive alternative. No action also received a good score because of its low cost but does not meet cleanup standards and, thus, cannot be used except in special circumstances (areas of ecological sensitivity).

This summary of the ranking of each alternative based on the comparative detailed analysis is further developed in Chapter 8, which describes the preferred alternatives in more detail.

### *7.6 Retained Alternatives: Small Scale Applications*

#### *7.6.1 No Action*

No action may have some applicability to some land use areas that are highly ecologically sensitive and isolated occurrences of chemicals. The Sequalitchew Creek Canyon (excluding railroad tracks), and the open space setbacks surrounding Old Fort Lake, require special consideration to the impacts required to cleanup existing contamination (largely low concentrations) vs. impacts to the local ecology if no action was taken. This net environmental benefit evaluation indicates that no action is a positive approach for these areas.

No action may also be appropriate for small isolated occurrences of chemicals that were not used or generated as part of the manufacturing activities or decommissioning of the buildings at the Site. For No Action to be an appropriate alternative the following conditions must be met:

- The contaminant must not have been detected in groundwater;
- Their concentrations are low (near the cleanup level);
- The average/mean concentration is below the cleanup level;
- The number of exceedances (less than 5%) of the cleanup level are low in comparison to the number of detections and/or samples collected; and
- No known sources for these contaminants are associated with activities at the Site.

### *7.6.2 Cap*

**General Process - Cap Construction:** In general, this alternative would involve the construction of an impermeable cap over existing soils containing contaminant concentrations above the CL but below the RL for a particular area. An example would be the use of an asphalt cap. In this case, the asphalt and subbase would act as the human health exposure barrier and the geotextile will act as the ecological exposure barrier. No excavation of underlying soils would occur.

**Applicable:** This alternative is potentially applicable to the following RUs:

- Open Space RUs; and
- Commercial RUs.

### *7.6.3 Cover*

**General Process - Cover Construction:** In general, this alternative would involve the construction of a thick (> 3 feet) soil cover over existing soils containing contaminant concentrations above the CL but below the RL for a particular area. A key component of this alternative is the required thickness of the cover necessary to create an effective barrier to human and ecological exposure. No excavation of underlying soils would occur.

**Applicable:** This alternative is potentially applicable to the following RUs:

- Historical Areas;
- Golf Course RUs; and
- Open Space RUs.

### *7.6.4 Cap/Cover*

**General Process – Cap/Cover:** This alternative involves the same cap/cover process described in Section 7.3 above but on a smaller scale. No excavation of underlying soils would occur.

In general this includes the construction of an engineered cap/cover 18 inches in thickness using one of the two methods listed below. This cap would be placed on any golf course land use areas with in-situ contaminant concentrations less than the golf course remediation level but greater than the Site-specific commercial remediation level.

**Method One:** Twelve inches of clean soil would be placed over six inches of gravel. In this process, the gravel would act as an exposure barrier to ecological receptors. The 12 inches of clean soil would act as an additional exposure barrier to humans.

**Method Two:** Eighteen inches of "pit run" soil would be placed over a geotextile. In this case, the 18 inches of soil would act as the human health exposure barrier and the geotextile will act as the ecological exposure barrier.

**Applicable:** This alternative is potentially applicable to the following RUs:

- Historical Areas;
- Golf Course RUs; and
- Open Space RUs.

### *7.6.5 Off-Site Disposal at a Landfill*

**General Process – Cap/Cover:** This alternative involves the same process described in Section 7.3 above but on a smaller scale. Soils above Site-specific CLs for non-lead and arsenic contaminated soils would be excavated, loaded into 30-ton trucks and hauled to and disposed of at an off-Site landfill.

**Applicable:** This alternative is potentially applicable to the following RUs:

- Miscellaneous Small RUs;
- Historical Areas;
- Golf Course RUs; and
- Open Space RUs.

## *7.7 Comparative Detailed Analysis of Alternatives – Small Scale Applications*

The following analysis uses the same criteria as listed in Section 7.2 above and provides information for the selection of a preferred alternative for each grouping of Miscellaneous Small Remediation Units.

The threshold criteria—protection of human health and the environment and compliance with cleanup standards—remain the same as those for large scale applications. Each retained alternative meets the threshold criteria for lead and arsenic, with the exception of No Action, which is retained for special considerations only.

The criteria to be used for the comparative detailed analysis of alternatives, as described in section 7.3 above, include the following:

- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, and volume;
- Short-term effectiveness;

- Implementability; and

- Considerations on Public Concerns.

### *7.7.1 Long-Term Effectiveness and Permanence*

**Magnitude of Residual Risk on-Site:** Each remedial alternative will have low residual risk since each will leave only acceptable concentrations of constituents (below the RL) on-Site. Some alternatives have less residual risk than others. Excavation of soil above the RL means that the Site meets the remediation levels, which are based on acceptable levels of risk. The following discussion relates to the relative magnitude of low residual risk from treated soil residuals generated by each alternative.

- The least residual risk on-Site will be associated with Off-Site Disposal at a Landfill. Implementation of this alternative will result in no known soil above chemical-specific CLs.

- Since they will meet clean up standards residual risk will be associated with the Cap, Cover or Cap/Cover alternatives be within limits acceptable to Ecology. Of these three alternatives, the least amount of residual risk is associated with the Cap and Cap/Cover alternatives. The effectiveness in reducing residual risk for the Cover alternative is associated with the thickness of the cover. A thick cover (>3 feet) represents the same degree of residual risk as the other two alternatives.

- The No Action alternative would not modify the current Site condition and residual risk would be similar to the current risk.

**Adequacy and Reliability of Controls:** The adequacy and reliability of controls relate to future land uses at the Site. Long-term development plans could impact three of the alternatives: Cap, Cover and Cap/Cover.

- The Off-Site Disposal at a Landfill alternative will require the lowest degrees of long-term management.

- The Site development plans support the long-term management of the Cap, Cover and/or Cap/Cover alternatives.

- No Action would require that general access to some impacted areas be restricted. Application of various institutional controls may be required to prevent exposure.

### *7.7.2 Reduction of Toxicity, Mobility, and Volume*

**Volume Reduction:** Because metals are present in Site soils, destruction/reduction of the elemental constituents is not an option. Thus, only soil volume reduction can occur. None of the retained alternatives reduces the volume of impacted soils; off-Site Disposal at a Landfill transfers the volume of impacted soil to the landfill.

**Mobility Reduction:** The pathway considered is direct contact. Alternatives, which involve excavation of soil above the RL, would permanently reduce the potential for direct contact exposure in the excavation area by removing the source of contamination.

- Off-Site Disposal at a Landfill would result in all soil above CLs being transported to a controlled landfill, where the mobility of the contaminants would have to be controlled by containment in the long-term.

- Capping, Cover and Cap/Cover result in constituents being placed in a controlled land use area. The potential for constituents in the soil to become available for direct contact is reduced by these controls. Developing and following health and safety procedures could limit exposure to workers during future subsurface construction or maintenance at deposition locations.

- No Action would not reduce the mobility of the contaminants at the Site.

**Toxicity Reduction:** No alternatives are intended to reduce the toxicity of lead or arsenic in soil.

### *7.7.3 Short-Term Effectiveness*

This evaluation criterion addresses the effects of the alternative during the construction and implementation phases of the cleanup action. Each alternative is evaluated with respect to the potential impact on human health of the surrounding community, Site workers, and the environment.

**Potential Community Exposure during Implementation:** Dust generation would be the primary concern during implementation and would need to be monitored so that the level of dust generated during soil handling does not exceed allowable levels in downwind areas. Dust control methods (i.e. applying water to work areas prior to and during excavation) would be required. Work done within 500 feet of the southern and eastern boundaries of the Site would require perimeter dust monitoring and dust prevention measures. The air quality impacts would be monitored to protect Site workers' health and safety. Transportation of soils off-Site may have a very low potential for exposure. As a result the quantity of material being excavated on-Site and/or transported to an off-Site landfill is the basis for this evaluation.

- No Action has the lowest risk associated with implementation since no soil is treated or removed from the Site.

- Cap, Cover and Cap/Cover will require management of dust generated during any excavation of soils and with the construction of the cap, cover or cap/cover. Since no contaminated materials will be used to construct these features no additional exposure risk is represented by one alternative vs. another. No off-Site transportation of soil would occur with these alternatives.

- Off-Site Disposal at a Landfill will require the most controls to minimize risk associated with dust generation. Dust generation associated with the excavation of the soil and transportation will require management because all soils above CLs will be transported to an appropriate landfill.

**Potential Worker Exposure during Implementation:** Personal protective equipment (PPE) appropriate for the type of potential exposure would be worn to reduce worker exposure. Workers would be trained in the health and safety procedures appropriate for their respective tasks, and operation of equipment (trucks, backhoes, and other heavy equipment) and would comply with the appropriate safety regulations.

The total volume of material handled and the use of water or extraction solutions are the leading criteria for this evaluation.

- No Action has the lowest worker exposure associated with implementation.

- Cap, Cover and Cap/Cover require management of dust generated during any excavation of soils and the construction of the cap and/or cover. Since no contaminated materials will be used to construct these features no additional exposure risk is represented by one alternative vs. another.

- Off-Site Disposal at a Landfill requires management of dust generated during the excavation of the contaminated soil, and management of transportation because all soils above the CL would be transported to the appropriate landfill.

**Potential Environmental Impacts:** All alternatives (except No Action) are believed to have the same impacts during the initial excavation of soils.

- No Action and Off-Site Disposal at Landfill will have the lowest potential for adverse impacts on the environment during the implementation.

- Cap, Cover and Cap/Cover will have a low potential for environmental impacts. The lead and arsenic constituents contained by these alternatives do not readily leach into the environment and represent very low potential for environmental impact. The Cap alternative, using an impermeable material, would further lower the already low potential by preventing water infiltration through the impacted soils.

**Time to Achieve RAOs:** Due to the small volumes associated with the remaining alternatives there is no difference in time to meet RAOs, with the exception of No Action which will require no time but does not meet RAOs.

#### *7.7.4 Implementability*

Due to the small-scale nature of this evaluation factors that impact implementability are, generally, comparable.

**Ability and Reliability of Technology:** No Action would not pose technical difficulties or problems. All remaining alternatives would be readily implementable.

**Availability of Services and Materials:** The availability of services and the necessary materials to achieve the RAOs are not anticipated to be a limiting factor and are unlikely to impact schedule for any of the remedial alternatives.

#### *7.7.5 Cost*

Cost will not be used as a evaluation criteria for small-scale applications. This decision was made for the following reasons:

- Costs associated with small-scale applications vary little between alternatives; and

- The majority of the applications that would use these alternatives have either special considerations (historic or ecological sensitively) or will only be defined (volume, time, etc.) once remediation occurs (Miscellaneous Small RUs).

#### *7.7.6 Consideration of Public Concerns*

Due to the small-scale of these applications there is little difference between alternatives. An exception occurs in areas of the Site that have great public interest (such as Sequalitchew Creek Canyon). As such, a detailed description of the processes that will be used to address these “special concerns” will be presented in Section 8.1.

### *7.8 Summary of the Detailed Analysis – Small Scale Applications*

Due to the small volumes associated with small scale applications an analysis involving weighting of criteria was not done. Selection of the preferred alternative was weighted toward permanence, net environmental benefit and impact to historical sites.

### *7.9 Preferred Alternative for Small Scale Applications*

Since cost was not considered in this evaluation, Cap/Cover and Off-Site Disposal are the preferred alternatives for small-scale applications. Capping could have limited applications. No action is applicable in areas of ecological sensitivity and for small isolated occurrences of chemicals that were not used or generated as part of the manufacturing activities or decommissioning of the buildings at the Site.

This summary of the ranking of each alternative based on the comparative detailed analysis is further developed in Section 8.1 and Section 8.3, which evaluates the preferred alternatives against Small RUs and the Miscellaneous Small Units, respectively.

## 7.10 Comparative Detailed Analysis of Alternatives – Groundwater

The following analysis uses the same criteria as listed in Section 7.2 above and provides information for the selection of a preferred alternative for groundwater. This detailed analysis of the two alternatives (Natural Restoration and Active Groundwater Treatment) will be comparative; the advantages and disadvantages of each retained alternative are identified and compared against the other alternative to determine their relative performance according to each criterion.

### 7.10.1 Long-Term Effectiveness and Permanence

**Magnitude of Residual Risk on-Site:** Each remedial alternative will have low residual risk since each would be conducted until groundwater reaches drinking water standards. As such, there is no difference between the alternatives.

**Adequacy and Reliability of Controls:** Both Active Treatment and Natural Restoration would rely upon deed restrictions to restrict the use of groundwater to non-potable uses. As such, there is no difference between the alternatives.

### 7.10.2 Reduction of Toxicity, Mobility, and Volume

**Volume Reduction:** Secondary treatment associated with the Active Groundwater Treatment alternative would destroy/reduce a small quantity of DNT that may be recovered. It would not, however, destroy/reduce residual DNT concentrations below the drinking water standard; the target of the treatment process. Natural Restoration would not destroy/reduce DNT.

**Mobility Reduction:** The pathway considered is direct contact. Each remedial alternative would limit transport since each would be conducted until groundwater reaches drinking water standards. As such, there is no difference between the alternatives.

**Toxicity Reduction:** Secondary treatment associated with the Active Groundwater Treatment alternative would destroy a small amount DNT that could be captured as part of the process. Natural Restoration would not destroy DNT.

### 7.10.3 Short-Term Effectiveness

This evaluation criterion addresses the effects of the alternative during the construction and implementation phases of the cleanup action. Each alternative is evaluated with respect to the potential impact on human health of the surrounding community, Site workers, and the environment.

**Potential Community Exposure during Implementation:** This aspect of short-term effectiveness addresses any risk that results from implementation of the proposed alternative, such as direct contact with contaminated groundwater, exposure to treatment chemicals, if any, during transport and air emissions resulting from equipment operation.

- Natural Restoration has the lowest risk associated with implementation since no actions, other than monitoring, occur.

- Active Groundwater Treatment involves the pumping, processing and treating up to 7,000 gallons of groundwater per minute (gpm). The storage of water and transportation of any treatment chemicals would require management especially during off-site transport.

**Potential Worker Exposure during Implementation:** This factor assesses potential threats that may be posed to the workers and the effectiveness and reliability of protective measures that would be taken during implementation of the cleanup action.

- Natural Restoration has the lowest risk associated with implementation since no actions, other than monitoring, occur.
- Active Groundwater Treatment, due to the magnitude of the process, involves a significant increase in risk associated with mechanical and safety hazards. Chemical hazards associated with any treatment chemicals would require special care.

**Potential Environmental Impacts:** Potential environmental impacts include but are not limited to: dispersion of constituents; erosion control in case of a release of treated water; spills of treatment chemical, if any; and wildlife exposure.

- Natural Restoration has the lowest risk associated with implementation since no groundwater is stored and treated.
- Active Groundwater Treatment, due to the magnitude of the process, involves a significant increase in the potential risk of releases stored or treated water. Treatment ponds would have to be created causing an attractive nuisance to wildlife, chemical hazards could exist due to treatment chemicals.

**Time to Achieve RAOs:** The time to complete either alternative is unknown. Gradually declining terms in DNT concentrations indicate that groundwater will eventually be naturally restored. Active Treatment will require up to 20 years, or longer, (Appendix I) to reach RAOs. Pump and treat systems poor historical performance in achieving drinking water standards could indicate that RAOs may never be reached.

### *7.10.4 Implementability*

The Implementability criterion addresses the technical feasibility of implementing the alternative and the availability of materials and services.

- Natural Restoration requires no implementation.
- Active Groundwater Treatment involves the construction, operations and maintenance of an extremely large treatment facility. Successfully implementing this alternative would be very difficult. The historical performance of groundwater pump and treat systems in restoring aquifers to drinking water standards has been poor suggesting that groundwater pump and treat to achieve drinking water standards everywhere in an aquifer may be technically infeasible (Appendix I).

**Ability and Reliability of Technology:** This evaluation relates to the technical difficulties and unknowns associated with the alternative.

- Natural Restoration is reliable and poses no technical difficulties.
- Pump and treat systems (Active Groundwater Treatment) have a poor historical performance in achieving drinking water standards. Concentrations in Site groundwater are already low enough that active groundwater pump and treat would likely be little or no more effective than natural restoration in removing the last residual DNT from Site aquifers

**Availability of Services and Materials:** Natural Restoration requires no services or materials. Pump and treat systems are readily available for small applications but not for the size required to treat the large volumes of groundwater at the Site. The treatment facility would have to be custom made. As such, materials would not be readily available.

#### 7.10.5 Cost

Cost is a major factor in the determination of the preferred alternative of groundwater remediation.

- Natural Restoration involves the monitoring of groundwater until drinking water standards are met. The cost of this activity is roughly $ 9,000 per year.

- Active Groundwater Treatment will require between $33,000,000 and $58,000,000.

#### 7.10.6 Consideration of Public Concerns

Since the goal of each alternative is groundwater concentrations below drinking water standards there is little difference between alternatives.

### 7.11 Summary of the Detailed Analysis

Analysis of the alternatives results in the following conclusions:

- Both Natural Restoration and Active Treatment will reach the same goal; drinking water standards; and thus, represent the same residual risk of exposure;

- Both Natural Restoration and Active Treatment will use deed restrictions to control future groundwater use;

- Active Groundwater Treatment could reduce/destroy a small amount of DNT;

- Active Groundwater Treatment represents a significantly greater risk for potential community, worker, and environmental exposure during implementation;

- Active Groundwater Treatment would be much more difficult to implement and may not be effective in reaching RAOs;

- Active Groundwater Treatment is much more costly; and

- Both Natural Restoration and Active Treatment address public concerns.

### 7.12 Preferred Alternative for Groundwater

The cost for Active Groundwater Treatment at the Former DuPont Works Site (Site) to meet the DNT drinking water screening level would be substantial and disproportionate to the degree of risk reduction which could be achieved. Therefore, in accordance with MTCA (WAC 173-340-360), it is impractical to consider active groundwater remediation at the Site for an end use (drinking water) that is not planned. Appendix I discusses the impracticability of this alternative. This conclusion is based on the following:

- Site groundwater poses no risk to human health or the environment.

    - Because off-Site drinking water supplies will supply more than double the full projected population of DuPont through the year 2020 , Site groundwater is not currently and will not in the future be used as a drinking water source (due to a deed restriction).

    - Future Site development plans will include deed restrictions as necessary to prevent drilling of drinking water supply wells;

    - Even assuming a hypothetical drinking water exposure that does not and will not exist at the Site, the highest DNT concentrations currently in Site aquifers (less than 0.5 µg/L) represent a worst-case risk of less than $4 \times 10^{-6}$, which meets a risk threshold of $l0^{-5}$;

  - o Current DNT concentrations pose no risk to golfers, other visitors, or golf course maintenance workers who would be most likely to encounter Site groundwater on a regular basis when it is used for golf course irrigation; and

  - o Site groundwater poses no risk to any Site ecological environment (including Sequalitchew Creek and Old Fort Lake) or off-Site ecological environment (e.g. Puget Sound).

- Natural groundwater recovery will occur following the completed interim DNT source removal. Removal of more than 40,000 cubic yards of DNT-impacted Site soils has been completed, thus the source of DNT to Site groundwater has been removed;

- Already low DNT concentrations in Site groundwater may decline further because Site aquifers are highly permeable and DNT is mobile, allowing natural flushing of DNT from the groundwater system and further reductions over time in the already low risk under a hypothetical drinking water scenario; and

- The current Site groundwater monitoring program will continue to document the DNT concentrations over time,

- Acknowledging groundwater pump and treat systems poor historical performance in achieving drinking water standards, the existing DNT concentrations in Site groundwater would represent a reasonable remediation endpoint at sites where active remediation is under consideration or underway.

- The cost to implement active groundwater remediation would be excessive, with preliminary estimates ranging between 33 and 58 million dollars. Consistent with the intent of MTCA and CERCLA, resources should be directed toward making substantive reductions in overall Site risk, which will be best accomplished at this Site by addressing other contaminants remaining in soils.

Considering the above, Natural Restoration is the preferred alternatives for groundwater.

## TABLE 7-1 - ESTIMATED TIMEFRAMES BY ALTERNATIVE
## FORMER DUPONT WORKS SITE
## DUPONT, WASHINGTON

| Estimate of Time to Completion (Work days) | Pre/Post-Construction | | CONSTRUCTION | | | | |
|---|---|---|---|---|---|---|---|
| Alternative | Design | Permitting and Reporting | Work Days (WD) | Additional WD: Screening | Additional WD: Disposal | Total Work Days | Total Years |
| No Action | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| On-Site Deposition, Cap and Cover; | 100 | 303 | 306 | | | 709 | 2.8 |
| Off-Site Disposal at a Landfill; and | 100 | 303 | 415 | | 1,083 | 1,902 | 7.6 |
| Wet Screening with On-Site Deposition, Cap/Cover and Disposal of the Residual Soils at a Landfill. | 170 | 303 | 306 | 100 | 10 | 889 | 3.6 |

# TABLE 7-2 - ESTIMATED LOW AND HIGH RANGE DIRECT COSTS
# FORMER DUPONT WORKS SITE
# DUPONT, WASHINGTON

| LOW RANGE UNIT COSTS<br>ALTERNATIVE | APPROX.<br>TOTAL<br>COST<br><br>($) |
|---|---|
| No Action | $0 |
| On-site Deposition with Cap/Cover | $9,200,000 |
| Off-site Disposal at Landfill | $125,900,000 |
| Wet Screening, On-site Deposition, Cap/Cover and Off-Site Disposal | $41,600,000 |

| HIGH RANGE UNIT COSTS<br>ALTERNATIVE | APPROX.<br>TOTAL<br>COST<br><br>($) |
|---|---|
| No Action | $0 |
| On-site Deposition with Cap/Cover | $15,000,000 |
| Off-site Disposal at Landfill | $172,800,000 |
| Wet Screening, On-site Deposition, Cap/Cover and Off-Site Disposal | $68,900,000 |

**Table 7-3 – Estimated Low and High Range Indirect Costs**

| LOW RANGE COSTS BY ALTERNATIVE | APPROX. DESIGN COSTS | APPROX. PUBLIC RELATIONS | APPROX. OVERSIGHT | APPROX. ADMIN & REPORTING | APPROX. Contingency | APPROX. TOTAL INDIRECT COSTS |
|---|---|---|---|---|---|---|
| | 5% | 1% | 10% | 3% | 25% | |
| No Action | $0 | $0 | $0 | $0 | $0 | $0 |
| On-site Deposition with Cap/Cover | $460,000 | $92,000 | $920,000 | $276,000 | $2,300,000 | $4,048,000 |
| Off-site Disposal at Landfill | $6,295,000 | $1,259,000 | $12,590,000 | $3,777,000 | $31,475,000 | $55,396,000 |
| Wet Screening, On-site Deposition, Cap/Cover and Off-Site Disposal | $2,080,000 | $416,000 | $4,160,000 | $1,248,000 | $10,400,000 | $18,304,000 |

| HIGH RANGE COSTS BY ALTERNATIVE | APPROX. DESIGN COSTS | APPROX. PUBLIC RELATIONS | APPROX. OVERSIGHT | APPROX. ADMIN & REPORTING | APPROX. Contingency | APPROX. TOTAL INDIRECT COSTS |
|---|---|---|---|---|---|---|
| | 5% | 1% | 10% | 3% | 25% | |
| No Action | $0 | $0 | $0 | $0 | $0 | $0 |
| On-site Deposition with Cap/Cover | $750,000 | $150,000 | $1,500,000 | $450,000 | $3,750,000 | $6,600,000 |
| Off-site Disposal at Landfill | $8,640,000 | $1,728,000 | $17,280,000 | $5,184,000 | $43,200,000 | $76,032,000 |
| Wet Screening, On-site Deposition, Cap/Cover and Off-Site Disposal | $3,445,000 | $689,000 | $6,890,000 | $2,067,000 | $17,225,000 | $30,316,000 |

**Table 7-4 – Estimated Low and High Range Total Costs**

| | LOW RANGE BY ALTERNATIVE TOTAL COST ($) | HIGH RANGE BY ALTERNATIVE TOTAL COST ($) | "BEST ESTIMATE" BY ALTERNATIVE TOTAL COST ($) |
|---|---|---|---|
| No Action | $0 | $0 | $0 |
| On-site Deposition with Cap/Cover | $13,248,000 | $21,600,000 | $17,424,000 |
| Off-site Disposal at Landfill | $181,296,000 | $248,832,000 | $215,064,000 |
| Wet Screening, On-site Deposition, Cap/Cover and Off-Site Disposal | $59,904,000 | $99,216,000 | $79,560,000 |

## Table 7-5 – Summary of Detailed Analysis

| Alternative | Long-Term Effectiveness and Permanence | | | | | | Short-Term Effectiveness | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Residual Risk | Adequacy and Reliability of Controls | Reduction of Volume | Reduction of Mobility | Reduction of Toxicity | **Subtotal** | Community Exposure | Worker Exposure | Environmental Impacts | Time to Achieve RAOs | **Subtotal** |
| No Action | 4 | 4 | 4 | 4 | 4 | **20** | 4 | 4 | 4 | 4 | **16** |
| On-site Deposition with Cap/Cover | 2 | 1 | 3 | 3 | 2 | **11** | 1 | 1 | 2 | 1 | **5** |
| Off-site Disposal at Landfill | 1 | 2 | 3 | 3 | 2 | **11** | 3 | 3 | 3 | 3 | **12** |
| Wet Screening, On-site Deposition, Cap/Cover and Off-Site Disposal | 2 | 1 | 2 | 3 | 2 | **10** | 2 | 2 | 1 | 2 | **7** |

| **Alternative** | **Implementability** | | | | **Cost** | **Overall Total Score** |
|---|---|---|---|---|---|---|
| | **Ability and Reliability of Technology** | **Additional Actions** | **Availability Services/ Materials** | **Subtotal** | | |
| No Action | 1 | 1 | 1 | **3** | **1** | **40** |
| On-site Deposition with Cap/Cover | 2 | 3 | 1 | **6** | **2** | **24** |
| Off-site Disposal at Landfill | 2 | 2 | 1 | **5** | **4** | **32** |
| Wet Screening, On-site Deposition, Cap/Cover and Off-Site Disposal | 4 | 4 | 1 | **9** | **3** | **29** |